Could the ISO be an effective Software Process Improvement Tool for the MSG?

To determine if the ISO would be an effective tool for the Material Systems Group (MSG) we must first examine the current tool being used. The Capability Maturity Model (CMM) is the current software process improvement tool being used by the MSG. The CMM was produced and introduced by the Software Engineering Institute (SEI) in 1991. The purpose of the CMM was to turn an ad hoc, immature software process into a mature one by covering practices for planning, engineering, and managing software development and maintenance.

The CMM is comprised of five levels, Level 1 – The Initial Level, at the initial level very little organized processes exist. It uses the heroic method for software maintenance. At this level the situation is most often described as being ad hoc and chaotic. Level 2 – The Repeatable Level, at this level a software development organization has in place the basic project management practices. Planning and managing new projects is based on experience with existing similar projects. During this level processes that have been defined, documented, practiced, measured, etc are implemented in the projects. Level 3 – The Defined Level, at this level processes that have proven to be successful have become the standard and are now used throughout the entire organization. The way the organization operates its' process is consistent at this level. Level 4 – The Managed Level, at this level measurable quality goals are set for the previous levels' (The Defined Level) processes and products. At this level trends in the process and product quality can be determined by an organization within the measurable bounds set. Level 5 – The Optimizing Level, at this level measures are being used to improve existing processes and evaluations of possible new processes are

taking place. It is during this level that an organization is ready to implement continuous process improvement. Continuous process improvement being the process of constantly studying and making changes in work activities to improve their quality, timeliness, efficiency and effectiveness. Continuous improvement focuses on improving quality and customer satisfaction by reducing the time cycle, product variations and eliminating waste.

In addition to these five levels, the CMM has Key Process Areas (KPAs) associated with each of the last four levels (Level 1 does not have any KPAs associated with it). The KPAs identify the issues that need to be addressed to achieve a particular maturity level. At level 2 the KPA focus is the software project. Level 2 has six KPAs and they are Requirements Management, Software Project Planning, Software Project Tracking and Oversight, Software Subcontract Management, Software Quality Assurance and Software Configuration Management. At level 3 both the project and organizational issues are addressed. Level 3 has seven KPAs and they are Organization Process Focus, Organization Process Definition, Training Program Integrated Software Management, Software Product Engineering, Intergroup Coordination and Peer Reviews. Level 4 focuses on establishing a measures for both the product and the process. Level 4 has two KPAs and they are Quantitative Process Management and Software Quality Management. Level 5 addresses issues from both the organization and the project and focuses on continuous process improvement. Level 5 has three KPAs and they are Defect Prevention, Technology Change Management and Process Change Management. Each KPA has key practices that are implemented in order to

satisfy the goals of the KPA. Some of these practices/activities will be listed and discussed later for comparative purposes. This concludes the basic description of the CMM.

The ISO 9000 evolved from existing standards, such as, the Department of Defense military standard MIL-Q-9858, adopted in 1959 and was later succeeded by quality standard MIL-Q-9858A in 1963. Other quality standards, that played a part in the development of the ISO 9000 standards were the NATO quality standard AQAP 1 and the British quality standard BS 5750. The ISO 9000 is a series of international standards developed by the International Organization for standards around 1987. The ISO 9000 series was written generically so that it would apply to a wide variety of industries. Due to its' generic characteristics it is open to interpretation, therefore highly trained quality auditors who understand quality systems and have specific industry experience will be needed to ensure correct ISO 9000 practices. The ISO 9000 series of standards is a set of documents that specify quality system requirements for use where a contract between two parties requires the demonstration of a supplier's capability to design and supply a product. The ISO 9000 focuses on three quality concepts:

- An organization should obtain and sustain the quality of the product or service produced so as to meet continually the purchaser's stated or implied needs.
- An organization should provide confidence to its own management that the intended quality is being obtained and sustained.
- An organization should provide confidence to the purchaser that the intended quality is being, or will be, obtained in the delivered product or service provided. When contractually required, the provision of confidence may involve agreed demonstration requirements.

The MSG is primarily a software development and maintenance organization, therefore, the ISO 9001 would be the pertinent standard from the ISO 9000 series of standards, for such an organization. The ISO 9001 is the Quality systems Model for quality assurance in design/development, production, installation, and servicing of software systems. The ISO 9000 has 20 quality system requirements. Each standard includes some or all of these system requirements. Example ISO 9003 has 12 of the system requirements and the ISO 9002 has 18 of the system requirements. The ISO 9001 however is the most comprehensive as it has all 20, system requirements. The following are the 20 system requirements with a brief overview: Management Responsibilities – A designated top manager is assigned to ensure that a quality program is implemented and maintained. Quality System Requirements – ISO requirements, procedures, and instructions are established and documented. Contract Review Requirements – All contracts are reviewed to determine if the requirements have been properly defined, agree with bid and can be implemented. Product Design Requirements – Procedures have been establish that control and verify the design. Document and Data Control – All document distribution and modification be controlled. Purchasing Requirements – Supplied products are inspected, tested and satisfy requirements. Purchaser-Supplied Products – All purchaser-supplied material be verified and maintained. Product Identification and Tracing – Products are identifiable and traceable throughout production. Process Control Requirements – Production processes are defined and planned. Product Inspection and Testing – Incoming and In-process materials are inspected and/or tested. Control of Inspection Equipment –

Equipment used for inspection and measuring is calibrated and maintained. Inspection and Test Status of Products – Inspection and/or testing status of products are positively identified. Control of Nonconforming Products – Nonconforming products are reworked, accepted, or scrapped and scrapped products are disposed of properly. Corrective and Preventive Action – Causes of nonconforming products are identified. Handling, Storage, and Delivery – Procedures for handling, storage, packaging, and delivery be established and maintained. Control of Quality Records – Quality records are collected, maintained, filed and indexed. Internal Quality Audit Requirements – Audits be planned and performed. Training Requirements – Training requirements are identified and appropriate training provided. Servicing Requirements – Service scope identified and service meets customer requirements. Statistical Techniques – Statistical techniques are used when necessary and statistical effectiveness is analyzed.

When reviewing details of the CMM and the ISO 9001 it appears in the early stages of these methods that the two are be primarily equal, with minor differences, however as the review progressed major differences began to surface. An attempt will be made to discuss a few of these differences from a CMM point-of-view. At level 2 of the CMM most of the KPA activities are covered in the ISO 9001. As the levels in the CMM increase fewer activities are covered in the ISO 9001. Starting at level 3 of the CMM, it was discovered during the review that organizational activities were not addressed in the ISO 9001. The two CMM KPAs that cover these activities are "Organization Process Focus" and "Organization Process Definition". Training is covered in the ISO 9001 with just a couple of activities from the CMM being overlooked, such as

activity 3 and 4, states, “The training for the organization is performed in accordance with the organization’s training plan” and “Training courses prepared at the organization level are developed and maintained according to organization standards”, respectively. Activities from the Integrated Software Management KPA are not covered in the ISO 9001. In the Software Product Engineering KPA, activity 4, which states, “The software code is developed, maintained, documented, and verified, according to the project’s defined software process, to implement the software requirements and software design” is not covered in the ISO 9001. Activity 1 in KPA Peer Reviews, states, “Peer review are planned, and the plans are documented”, is not covered in the ISO 9001. In level 3, the only KPA completely covered by the ISO 9001 is Intergroup Coordination. At level 4 one KPA activity is covered under the ISO 9001 system requirements. Under the Software Quality Management KPA activity 3 is covered under the ISO 9001 Internal Quality Audit system requirement. Under the level 5 KPAs it appears that none of the activities are covered in the ISO 9001.

In conclusion, could the ISO 9000 be used as a Software Process Improvement Tool for the MSG? Yes, it could have been used as a software process improvement tool however, I do not feel it would have been the best tool. Before reviewing both methods, I felt the CMM was just a re-make of the ISO 9000. I questioned why SEI would re-create the wheel since there was an international standard already in place. Furthermore, although the CMM was developed to apply to both a development and maintenance environment, and falls short on maintenance (due to the practices for maintenance being embedded throughout the CMM), it still appears to be the better

choice. Upon my research I found that the CMM works by progression or evolution. Each stage/level of the CMM evolves closer to the ultimate goal of continuous improvement. An organization using the ISO 9000 can become stagnant (unless the organization is a self-motivating organization) and the goal of continuous improvement may never materialize. The reason for the possible stagnation is because the ISO 9000 is a method of software improvement that defines a minimum requirement or floor in which an organization must not fall below. It was further noted that up to a level 2 that an organization using ISO 9000 and an organization using the CMM would be about even in their software improvement practices. After level 2, an organization using the ISO 9000 and seeking a level 3 or higher certification under the CMM would more than likely not be able to achieve that certification. The ISO 9000 series of standards also seem to be fragmented which adds some confusion to the puzzle. For instance, the ISO 9001 standard has other puzzle pieces that need to be applied for interpretation, those pieces are the ISO 9000-3 and the TickIT, which were not discussed in this paper. The ISO 9000-3 however, is a guideline for the application of the ISO 9001 and the TickIT is a guide that contains information on using the ISO 9000-3!

References

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